## 7.3. Output Power Measurement

### 7.3.1.Test Limit

The maximum out power permissible output power is 1 Watt for frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.And for antenna gain greater than 6dBi the limit shall reduce by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

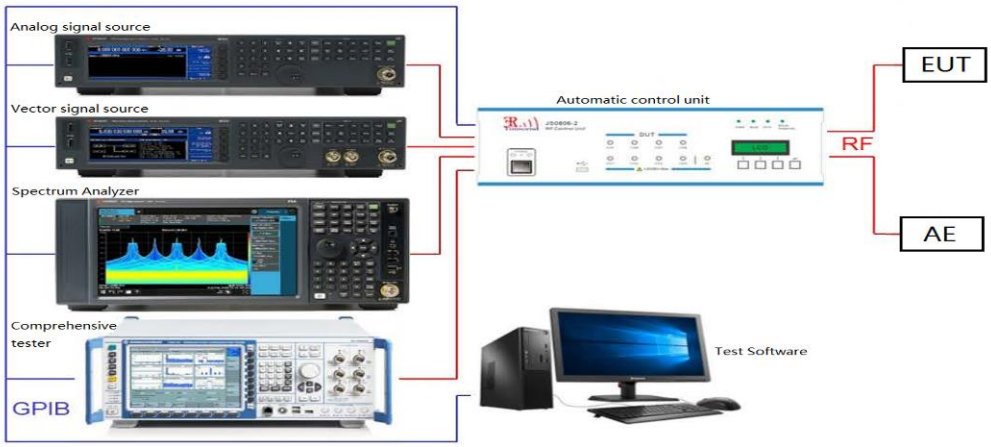
### 7.3.2.Test Procedure Used

ANSI C63.10-2013 - Section 7.8.5

### 7.3.3.Test Setting

1. Set RBW ≥ the 20 dB bandwidth of the emission being measured.
2. VBW ≥ RBW
3. Span = approximately five times the 20dB bandwidth, centered on a hopping channel
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. Allow the trace to stabilize, Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power (don’t forget added the external attenuation and cable loss)

### 7.3.4.Test Setup

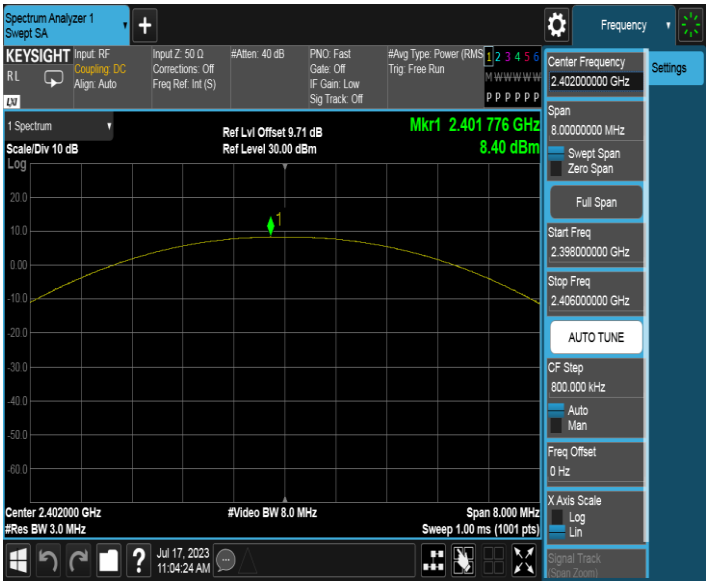


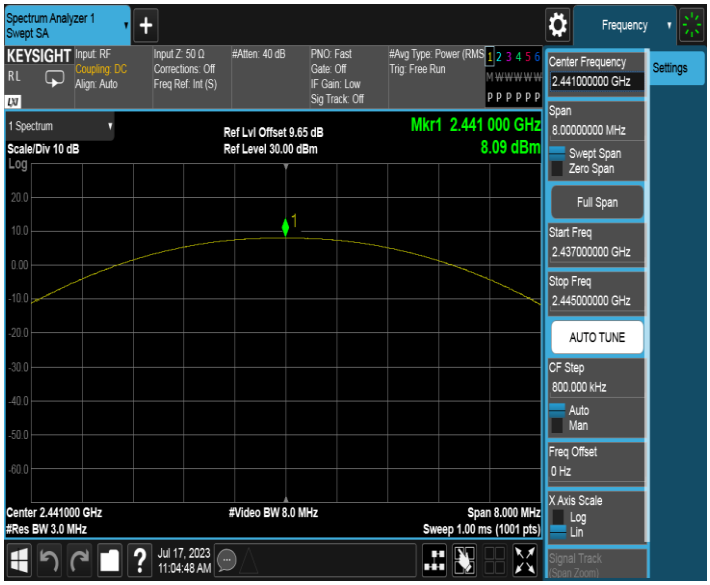
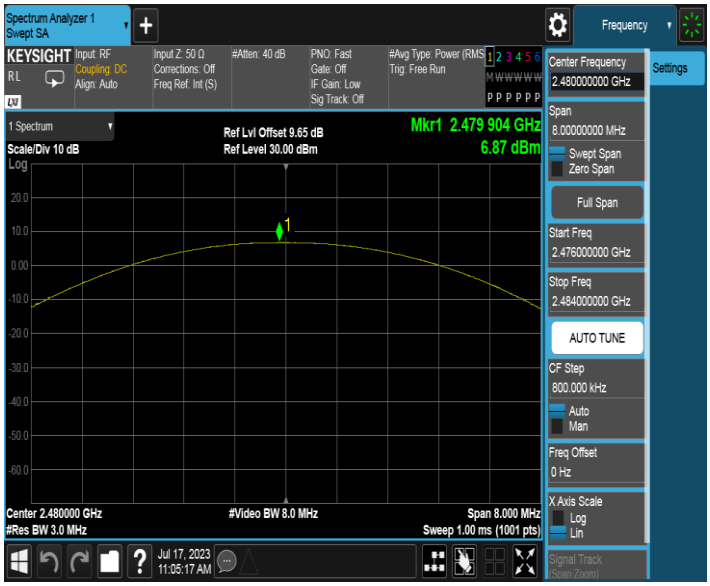
### 7.3.5.Test Result

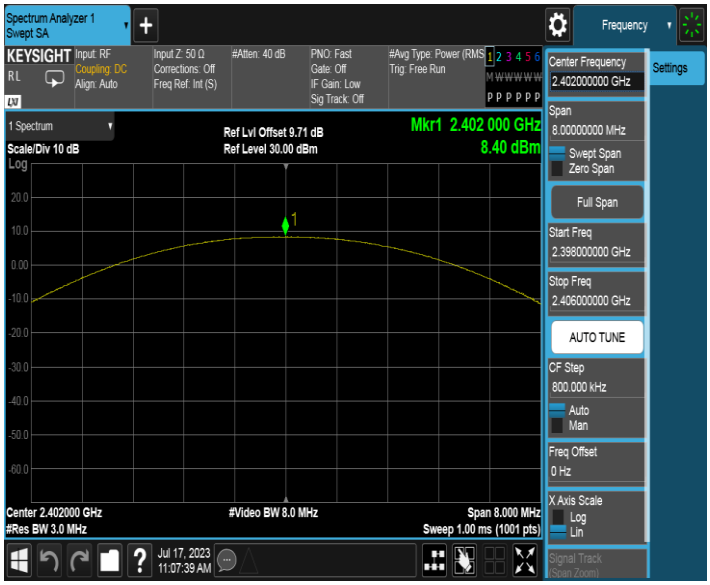
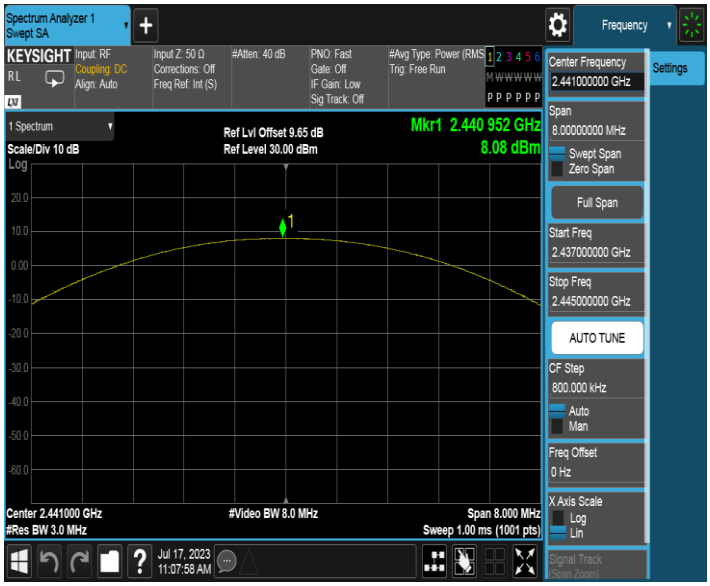
| Test Mode | Antenna | Channel | Result[dBm] | Limit[dBm] | Verdict |
|---|---|---|---|---|---|
| DH5 | Ant1 | 2402 | 8.40 | ≤30 | PASS |
| | | 2441 | 8.09 | ≤30 | PASS |
| | | 2480 | 6.87 | ≤30 | PASS |
| 2DH5 | Ant1 | 2402 | 8.40 | ≤30 | PASS |
| | | 2441 | 8.08 | ≤30 | PASS |
| | | 2480 | 6.88 | ≤30 | PASS |
| 3DH5 | Ant1 | 2402 | 8.82 | ≤30 | PASS |
| | | 2441 | 8.59 | ≤30 | PASS |
| | | 2480 | 7.38 | ≤30 | PASS |

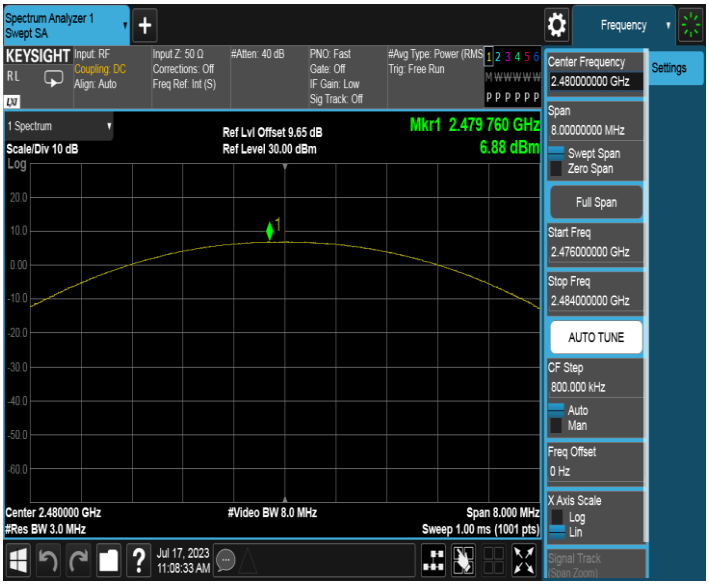
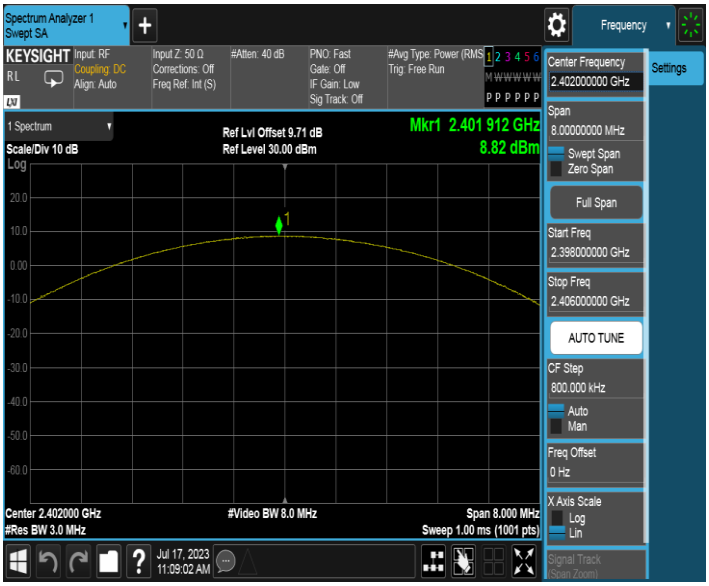
## Test Graphs

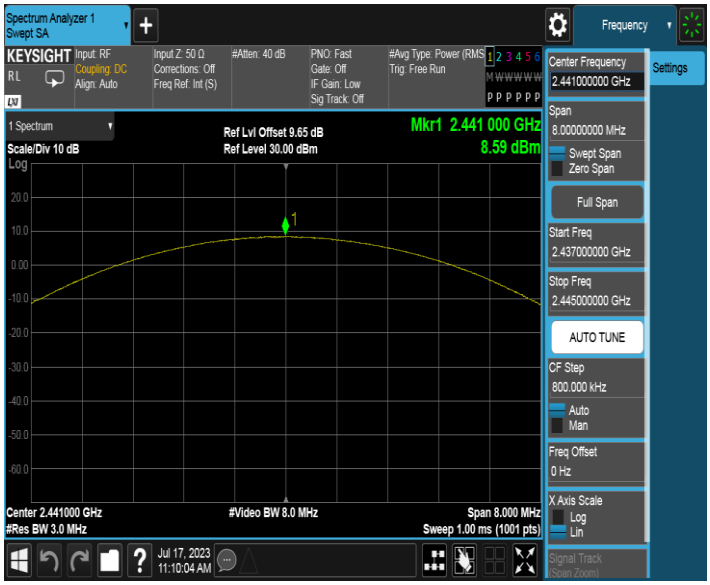
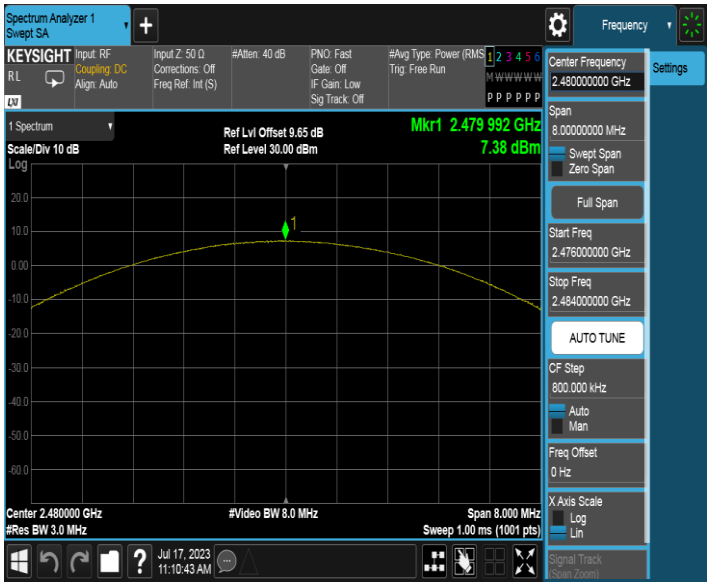
DH5_Ant1_2402



| DH5_Ant1_2441 |
| --- |
|  |
| DH5_Ant1_2480 |
|  |

| 2DH5_Ant1_2402 |
| --- |
|  |
| 2DH5_Ant1_2441 |
|  |

| 2DH5_Ant1_2480 |
| --- |
|  |
| 3DH5_Ant1_2402 |
|  |

| 3DH5_Ant1_2441 |
| --- |
|  |
| 3DH5_Ant1_2480 |
|  |

## 7.4. Carrier Frequency Separation Measurement

### 7.4.1.Test Limit

Frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

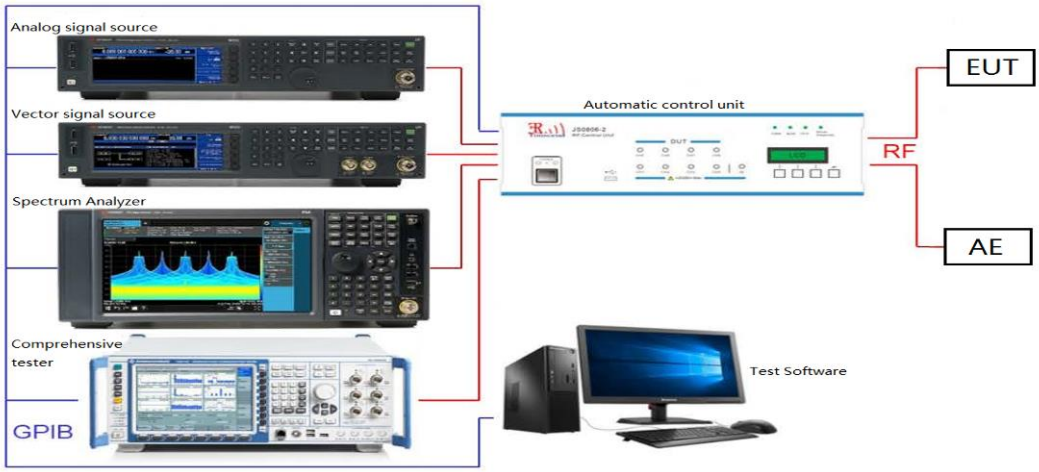
### 7.4.2.Test Procedure Used

ANSI C63.10-2013 - Section 7.8.2

### 7.4.3.Test Setting

1. Span = wide enough to capture the peaks of two adjacent channels.
2. Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
3. VBW ≥ RBW
4. Sweep time = Auto couple
5. Detector = Peak
6. Trace mode = Max hold
7. Allowed the trace to stabilize
8. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

### 7.4.4.Test Setup

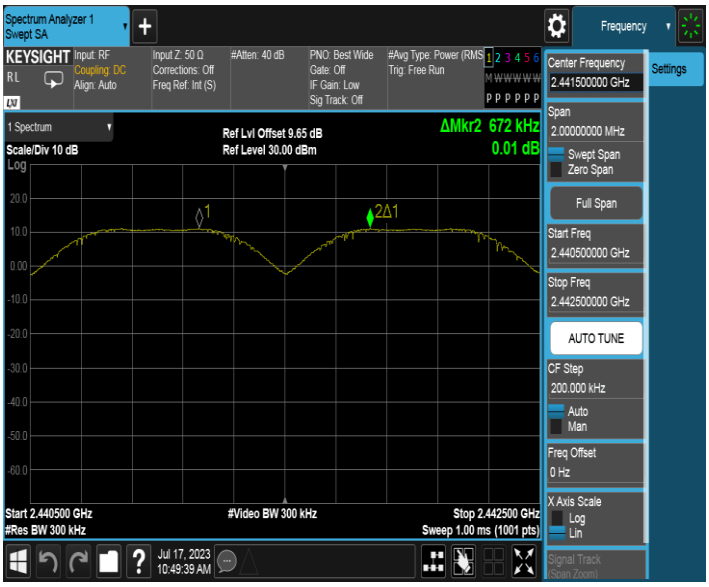


### 7.4.5.Test Result

| Test Mode | Antenna | Channel | Result[MHz] | Limit[MHz] | Verdict |
|---|---|---|---|---|---|
| DH5 | Ant1 | Hop | 0.672 | ≥0.644 | PASS |
| 2DH5 | Ant1 | Hop | 1.014 | ≥0.850 | PASS |
| 3DH5 | Ant1 | Hop | 1.016 | ≥0.854 | PASS |

## Test Graphs

DH5_Ant1_Hop




2DH5_Ant1_Hop

| 3DH5_Ant1_Hop |
| --- |
|  |

## 7.5. Number of Hopping Channels Measurement

### 7.5.1.Test Limit

This frequency hopping system must employ a minimum of 15 hopping channels.

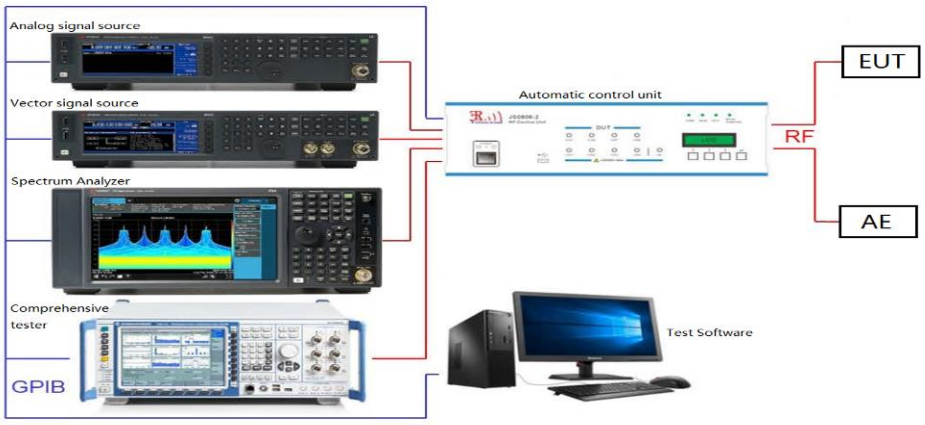
### 7.5.2.Test Procedure Used

ANSI C63.10-2013 - Section 7.8.3

### 7.5.3.Test Settitng

1. Span = the frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
2. To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
3. VBW ≥ RBW
4. Sweep time = Auto couple
5. Detector = Peak
6. Trace mode = Max hold
7. Allow the trace to stabilize

### 7.5.4.Test Setup

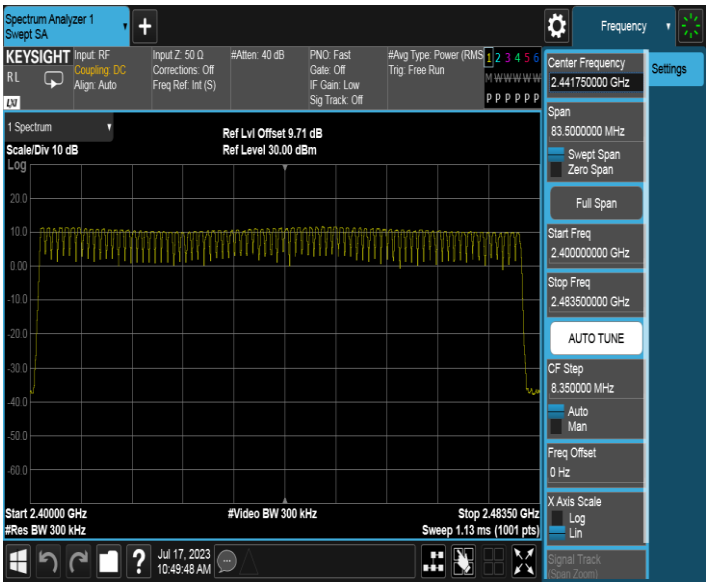


### 7.5.5.Test Result

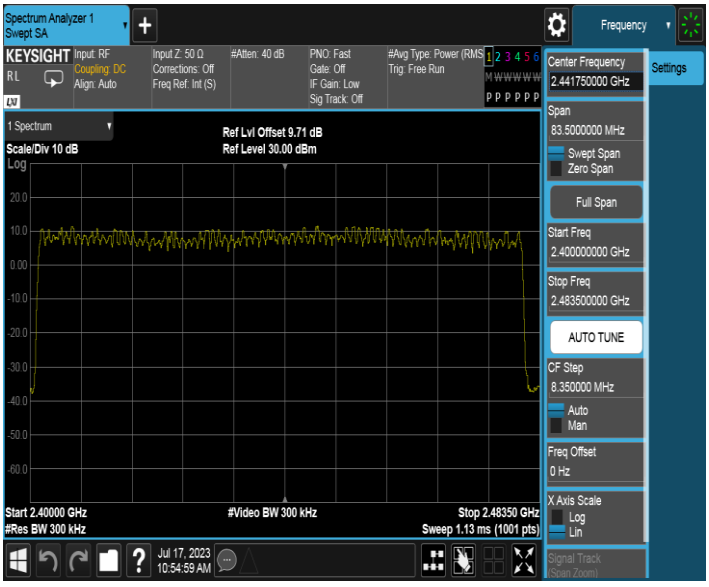
| Test Mode | Antenna | Channel | Result[Num] | Limit[Num] | Verdict |
|---|---|---|---|---|---|
| DH5 | Ant1 | Hop | 79 | ≥15 | PASS |
| 2DH5 | Ant1 | Hop | 79 | ≥15 | PASS |
| 3DH5 | Ant1 | Hop | 79 | ≥15 | PASS |

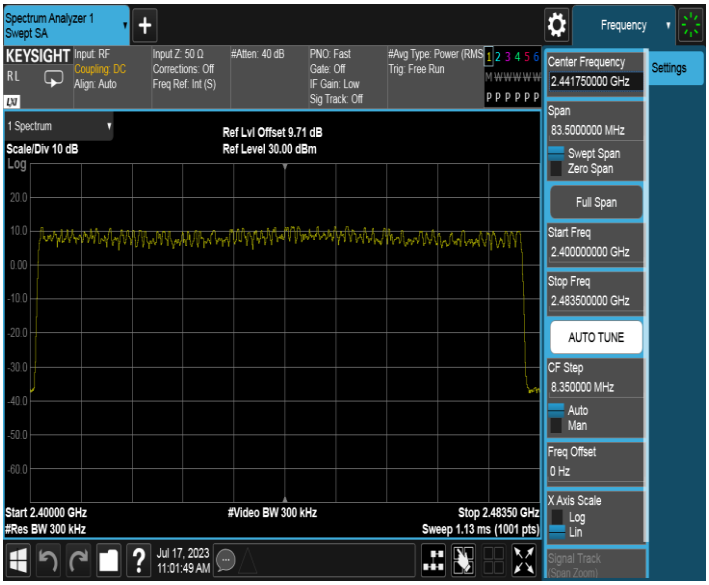
## Test Graphs

DH5_Ant1_Hop




2DH5_Ant1_Hop



| 3DH5_Ant1_Hop |
| --- |
|  |

## 7.6. Time of Occupancy Measurement

### 7.6.1.Test Limit

The maximum permissible time of occupancy is 400ms within a period of 400ms multiplied by the number of hopping channels employed.

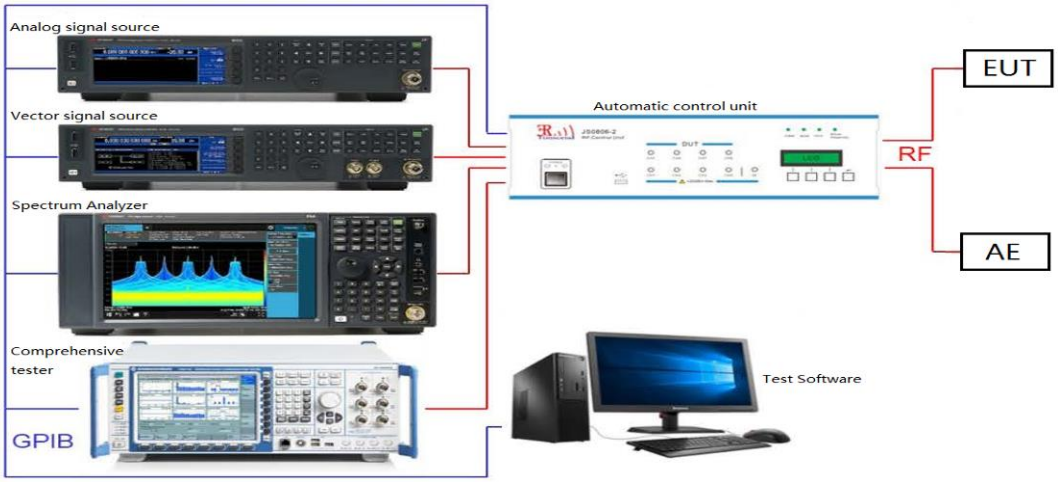
### 7.6.2.Test Procedure Used

ANSI C63.10-2013 - Section 7.8.4

### 7.6.3.Test Settitng

1. Span = zero span, centered on a hopping channel.
2. RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.
3. VBW ≥ RBW
4. Sweep time = as necessary to capture the entire dwell time per hopping channel
5. Detector = Peak
6. Trace mode = max hold
7. Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time. An oscilloscope may be used instead of a spectrum analyzer. The EUT shall show compliance with the appropriate regulatory limit for the number of hopping channels. A plot of the data shall be included in the test report.

### 7.6.4.Test Setup



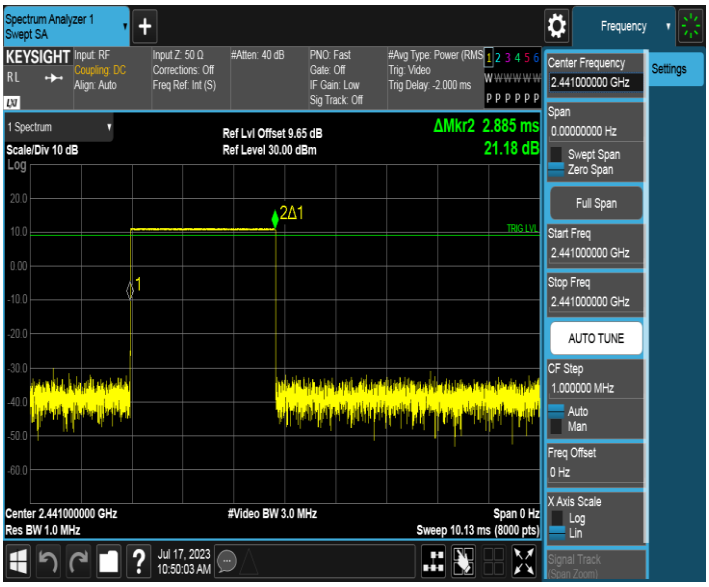
### 7.6.5.Test Result

| Test Mode | Antenna | Channel | BurstWidth [ms] | TotalHops [Num] | Result[s] | Limit[s] | Verdict |
|---|---|---|---|---|---|---|---|
| DH5 | Ant1 | Hop | 2.885 | 106.67 | 0.308 | ≤0.4 | PASS |
| 2DH5 | Ant1 | Hop | 2.891 | 106.67 | 0.308 | ≤0.4 | PASS |
| 3DH5 | Ant1 | Hop | 2.893 | 106.67 | 0.309 | ≤0.4 | PASS |

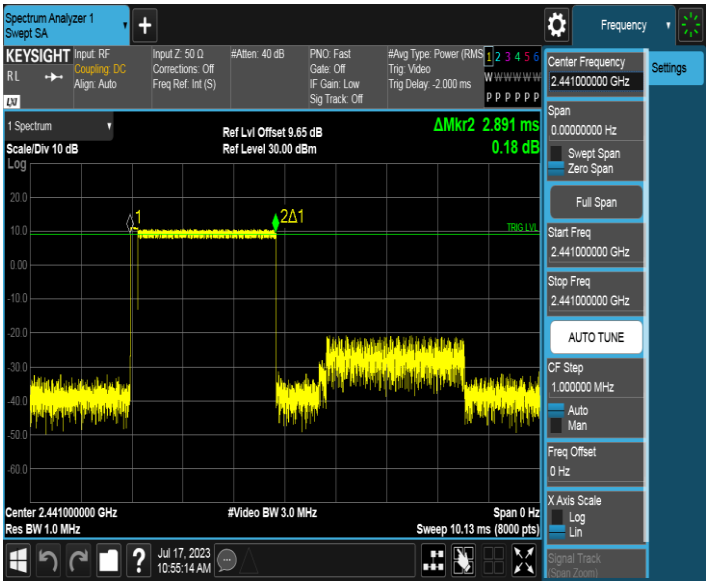
Note：TotalHops is the number of bursts measured in a scan time of 31.6 seconds.

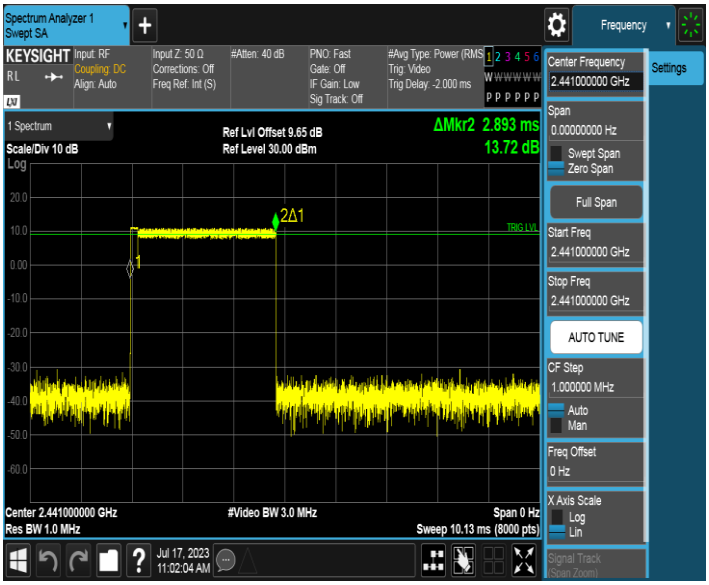
## Test Graphs

DH5_Ant1_Hop




2DH5_Ant1_Hop



| 3DH5_Ant1_Hop |
| --- |
|  |

## 7.7. Band-edge Compliance Measurement

### 7.7.1.Test Limit

The maximum permissible emission level is 20dBc. Any emissions were lying outside of the emission bandwidth and in authorized band edges to a field strength limit specified in Section 15.209 of the Title 47 CFR.

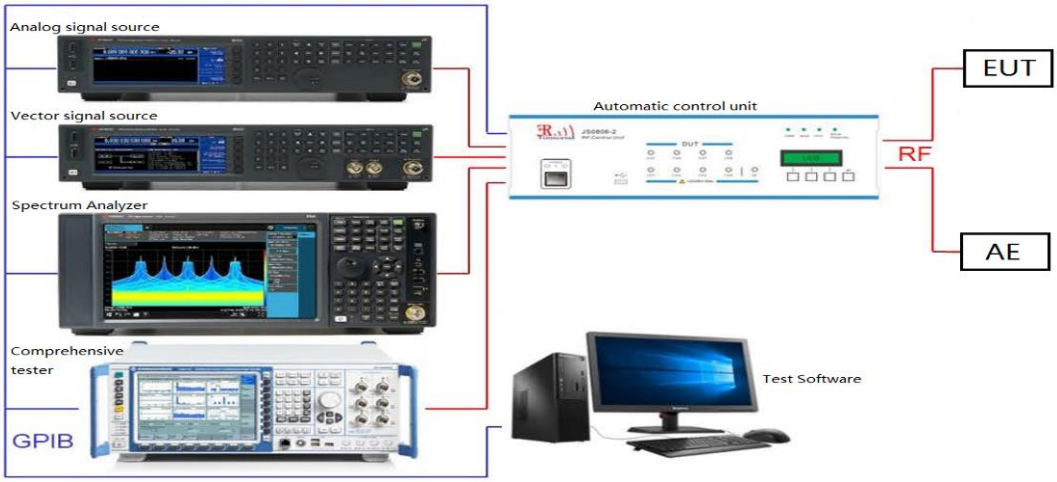
### 7.7.2.Test Procedure Used

ANSI C63.10-2013 - Section 6.10.4

### 7.7.3.Test Setting

1. Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation.
2. RBW = 100kHz
3. VBW = 300kHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize
8. Allow the trace to stabilize. Set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge. Enable the marker-delta function, than use the marker-to-peak function to move the marker to the peak of the in-band emission.

### 7.7.4.Test Setup

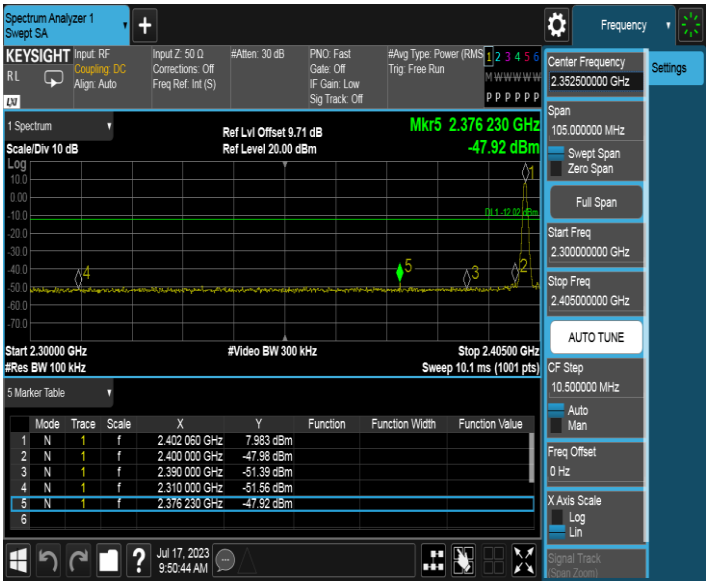


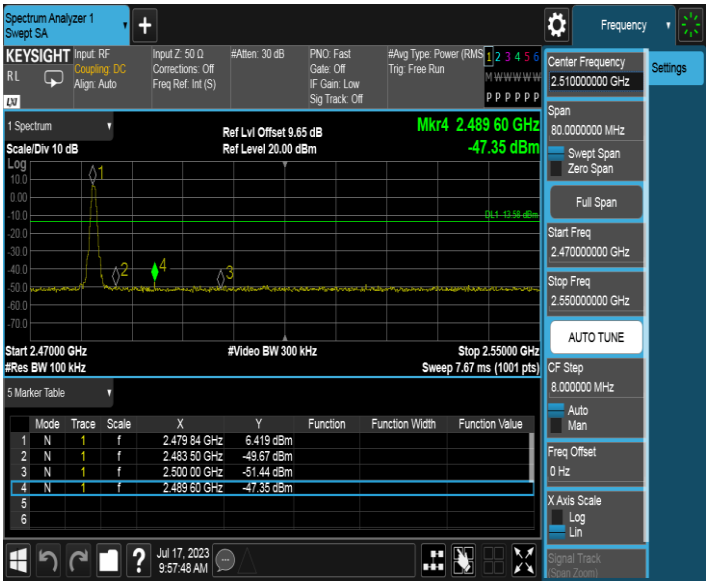
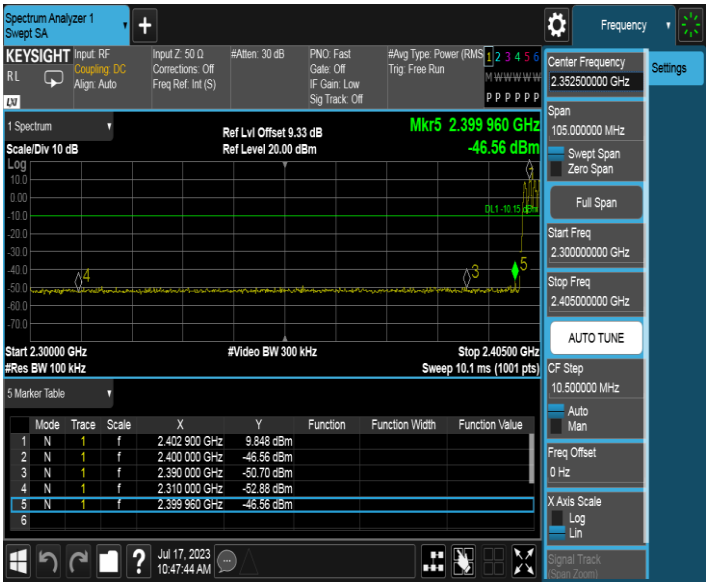
### 7.7.5.Test Result

| Test Mode | Antenna | Ch Name | Channel | Ref Level [dBm] | Result [dBm] | Limit [dBm] | Verdict |
|---|---|---|---|---|---|---|---|
| DH5 | Ant1 | Low | 2402 | 7.98 | -47.92 | ≤-12.02 | PASS |
| | | High | 2480 | 6.42 | -47.35 | ≤-13.58 | PASS |
| | | Low | Hop_2402 | 9.85 | -46.56 | ≤-10.15 | PASS |
| | | High | Hop_2480 | 9.48 | -49.04 | ≤-10.53 | PASS |
| 2DH5 | Ant1 | Low | 2402 | 8.06 | -46.67 | ≤-11.95 | PASS |
| | | High | 2480 | 6.48 | -48.68 | ≤-13.52 | PASS |
| | | Low | Hop_2402 | 6.37 | -48.74 | ≤-13.63 | PASS |
| | | High | Hop_2480 | 7.50 | -48.32 | ≤-12.5 | PASS |
| 3DH5 | Ant1 | Low | 2402 | 8.03 | -46.23 | ≤-11.97 | PASS |
| | | High | 2480 | 6.45 | -48.18 | ≤-13.55 | PASS |
| | | Low | Hop_2402 | 10.35 | -46.96 | ≤-9.65 | PASS |
| | | High | Hop_2480 | 9.26 | -48.30 | ≤-10.74 | PASS |

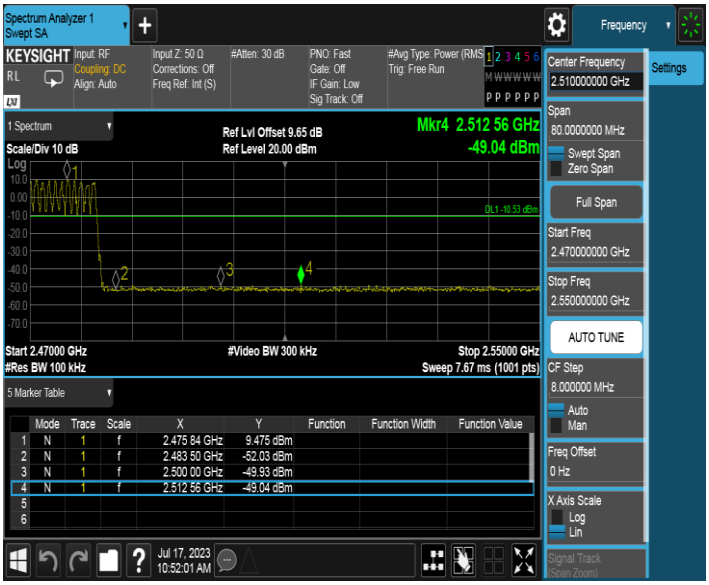
## Test Graphs

DH5_Ant1_Low_2402

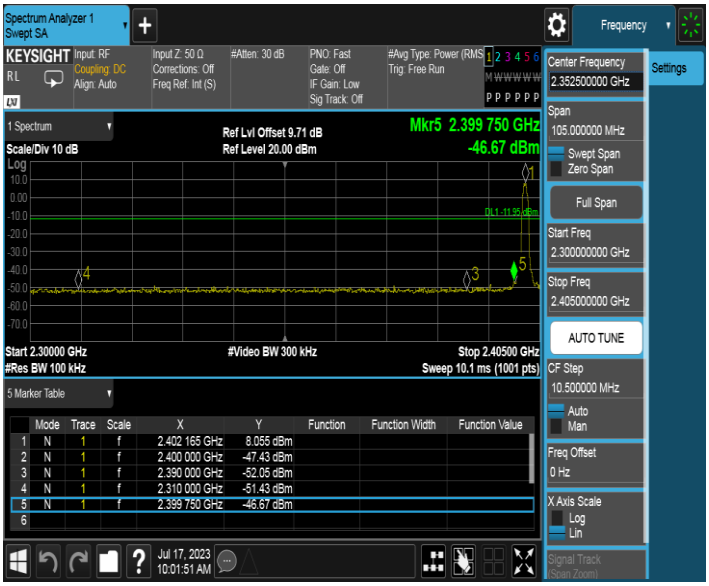


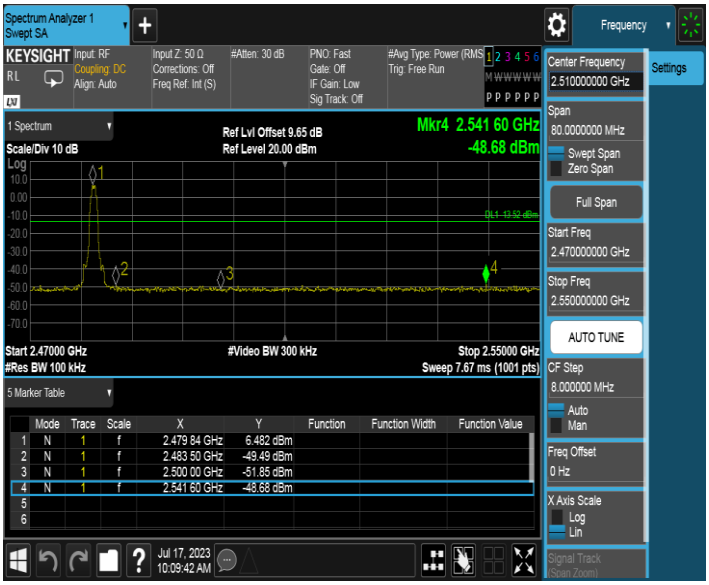
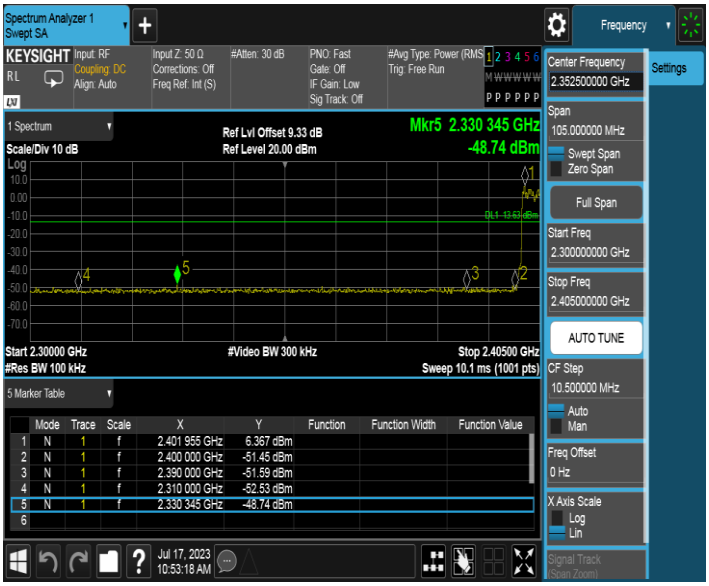
| DH5_Ant1_High_2480 |
| --- |
|  |
| DH5_Ant1_Low_Hop_2402 |
|  |

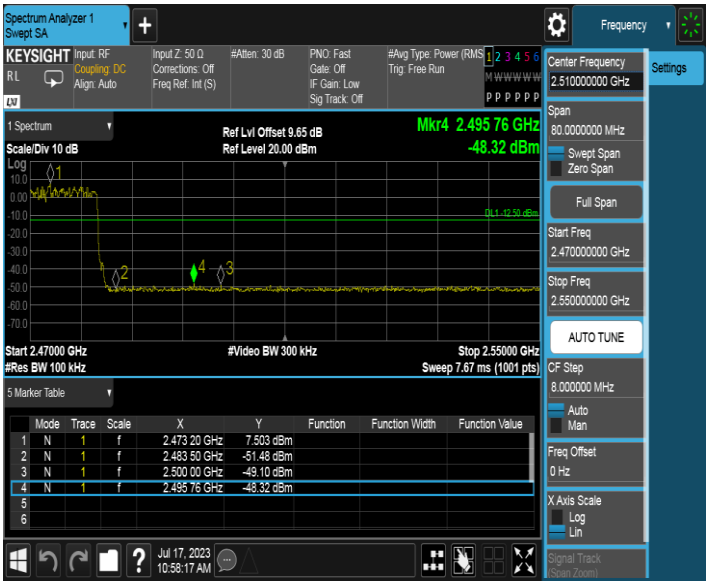
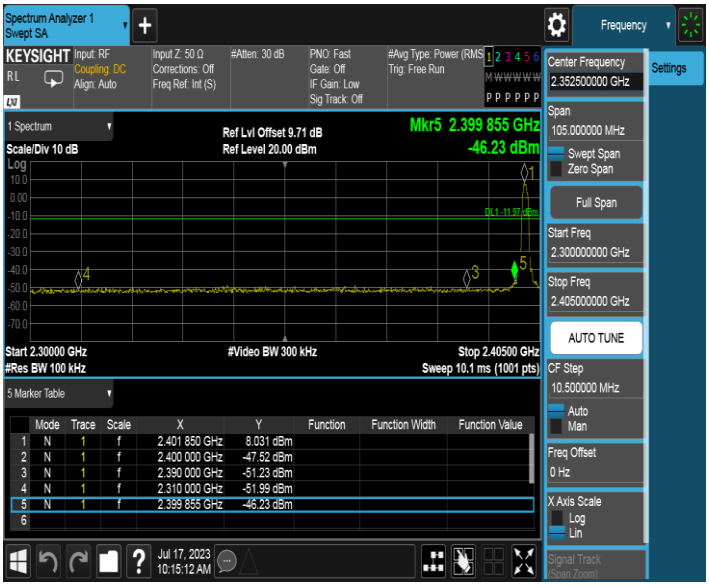
DH5_Ant1_High_Hop_2480

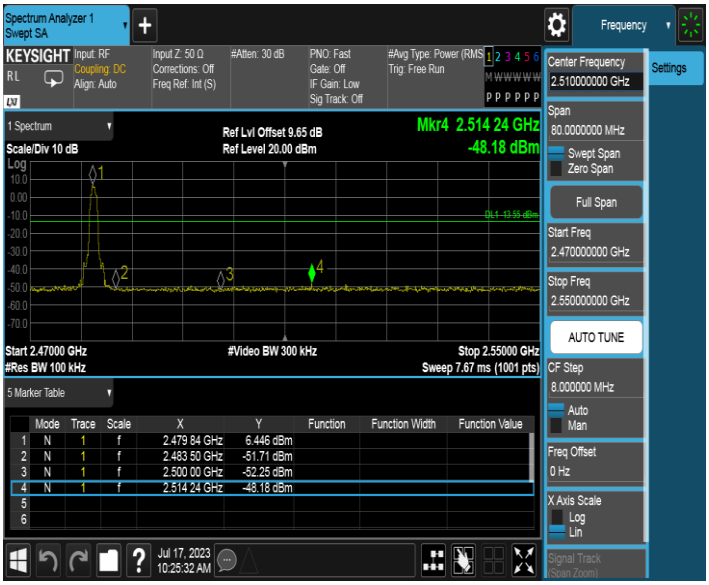
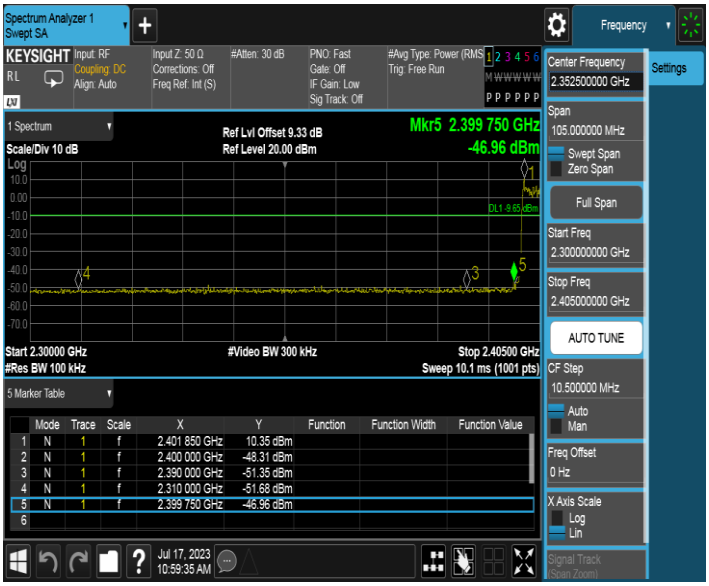


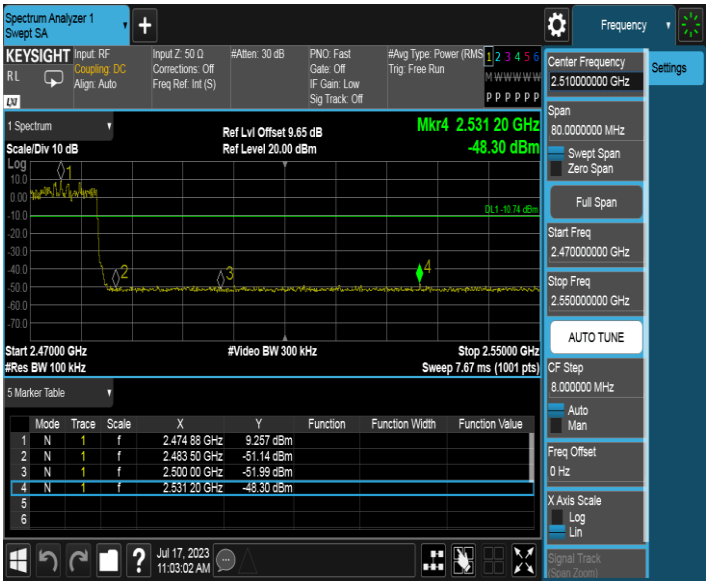

2DH5_Ant1_Low_2402



| 2DH5_Ant1_High_2480 |
| --- |
|  |
| 2DH5_Ant1_Low_Hop_2402 |
|  |

| 2DH5_Ant1_High_Hop_2480 |
| --- |
|  |
| 3DH5_Ant1_Low_2402 |
|  |

| 3DH5_Ant1_High_2480 |
| --- |
|  |
| 3DH5_Ant1_Low_Hop_2402 |
|  |

| 3DH5_Ant1_High_Hop_2480 |
| --- |
|  |

## 7.8. Conducted Spurious Emissions Measurement

### 7.8.1.Test Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

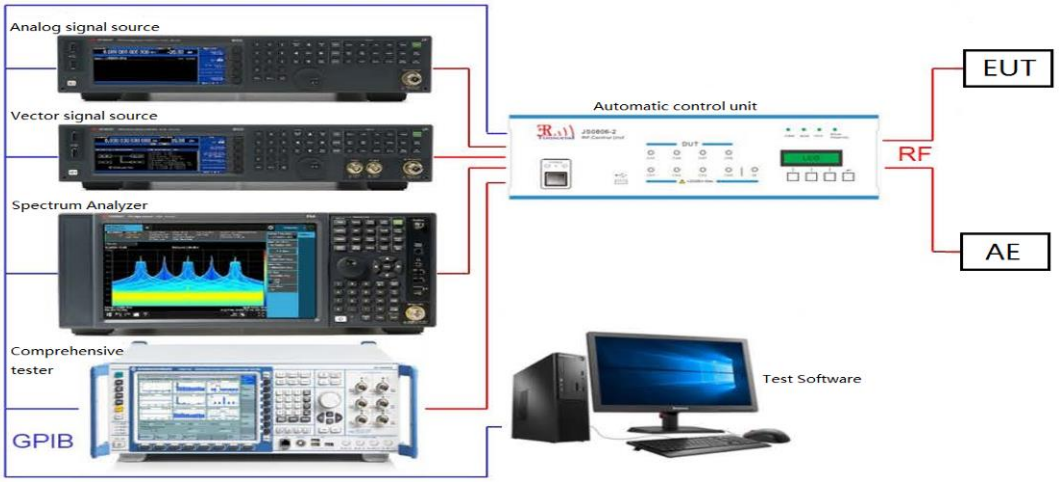
### 7.8.2.Test Procedure Used

ANSI C63.10-2013 - Section 7.8.8

### 7.8.3.Test Setting

1. Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
2. RBW = 100 KHz
3. VBW ≥ RBW
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize
8. Set the marker on the peak of any spurious emission recorded. The level displayed must comply with the limit specified in this section.

### 7.8.4.Test Setup



### 7.8.5.Test Result

| Test Mode | Antenna | Channel | Freq Range [MHz] | Ref Level [dBm] | Result [dBm] | Limit [dBm] | Verdict |
|---|---|---|---|---|---|---|---|
| DH5 | Ant1 | 2402 | Reference | 7.90 | 7.90 | --- | PASS |
| | | | 30~1000 | 7.90 | -59.84 | ≤-12.1 | PASS |
| | | | 1000~26500 | 7.90 | -51.55 | ≤-12.1 | PASS |
| | | 2441 | Reference | 7.51 | 7.51 | --- | PASS |
| | | | 30~1000 | 7.51 | -60.39 | ≤-12.49 | PASS |
| | | | 1000~26500 | 7.51 | -50.7 | ≤-12.49 | PASS |
| | | 2480 | Reference | 6.30 | 6.30 | --- | PASS |
| | | | 30~1000 | 6.30 | -59.7 | ≤-13.7 | PASS |
| | | | 1000~26500 | 6.30 | -51.37 | ≤-13.7 | PASS |
| 2DH5 | Ant1 | 2402 | Reference | 7.97 | 7.97 | --- | PASS |
| | | | 30~1000 | 7.97 | -59.27 | ≤-12.03 | PASS |
| | | | 1000~26500 | 7.97 | -50.57 | ≤-12.03 | PASS |
| | | 2441 | Reference | 7.71 | 7.71 | --- | PASS |
| | | | 30~1000 | 7.71 | -54.87 | ≤-12.29 | PASS |
| | | | 1000~26500 | 7.71 | -52.03 | ≤-12.29 | PASS |
| | | 2480 | Reference | 6.39 | 6.39 | --- | PASS |
| | | | 30~1000 | 6.39 | -52.64 | ≤-13.61 | PASS |
| | | | 1000~26500 | 6.39 | -51.88 | ≤-13.61 | PASS |
| 3DH5 | Ant1 | 2402 | Reference | 7.97 | 7.97 | --- | PASS |
| | | | 30~1000 | 7.97 | -59.89 | ≤-12.03 | PASS |
| | | | 1000~26500 | 7.97 | -50.26 | ≤-12.03 | PASS |
| | | 2441 | Reference | 7.72 | 7.72 | --- | PASS |
| | | | 30~1000 | 7.72 | -60.5 | ≤-12.28 | PASS |
| | | | 1000~26500 | 7.72 | -50.66 | ≤-12.28 | PASS |
| | | 2480 | Reference | 6.44 | 6.44 | --- | PASS |
| | | | 30~1000 | 6.44 | -56.3 | ≤-13.56 | PASS |
| | | | 1000~26500 | 6.44 | -51.13 | ≤-13.56 | PASS |